Chapter 4

Videogame Addiction: Fact or Fiction?

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The popularity of videogames as a leisure phenomenon has become an ever-increasing part of many people's lives. Videogames are widely marketed to adults and children and are readily available in most countries around the world. This leisure activity, however, has recently become the target of criticism within the media. There have been a growing number of reports about excessive use of videogames by both children and adults (often referred to as "joystick junkies") to the extent that some users are being identified as videogame addicts This concept of "videogame addiction" is a relatively new concept that is currently causing many to rethink more traditional views about what constitutes addiction. Although the concept of "videogame addiction" appears to have its supporters in the media, there is much skepticism within the academic community—especially among those working in the field of addiction research. For many in the academic environment, the concept of videogame addiction seems farfetched, particularly if their concepts and definitions of addiction are based on the criteria typically associated with addictions to psychoactive drugs. Despite the predominance of drug-based definitions of addiction, there is now a growing movement which views a number of *behaviors* as potentially addictive. For example some have identified gambling, computer game playing, exercise, sex, and now the Internet as potentially addictive behaviors. Such diversity in addictive agents (drugs or behaviors) has led to new all-encompassing definitions of what constitutes addictive behavior.

The first step in expanding the definition of addiction to include videogaming requires a full examination of what we know and what we need to know about videogaming behavior. Specifically, research into the area of videogame addiction needs to be underpinned by three fundamental questions: (1) What is addiction? (2) Does videogame addiction exist? (3) If videogame addiction exists, what are people actually addicted to?

What Is Addiction?

This first question continues to be a much-debated question both among psychologists within the field of addiction research as well as those working in other disciplines. For many years, I have operationally defined addictive behavior as any behavior that features all the core components of addiction. For example, throughout my own research examining the psychology of gambling, I have consistently argued that excessive gambling is no different from alcoholism or heroin addiction in terms of the core components of addiction (i.e., salience, mood modification, tolerance, withdrawal, conflict, relapse, etc.). If it can be shown that a behavior like pathological gambling can be a bona fide addiction then there is a precedent that any behavior which can provide continuous rewards in the absence of a psychoactive substance can be potentially addictive (i.e., a behavioral as opposed to a chemical addiction). Such a precedent "opens the floodgates" for other excessive behaviors to be theoretically considered as potential addictions (such as videogames).

It has been alleged for almost 25 years that social pathologies exist among excessive videogame players. For instance, Soper and Miller (1983) claimed "videogame addiction" was like any other behavioral addiction and consisted of a compulsive behavioral involvement, a lack of interest in other activities, association mainly with other addicts, and physical and mental symptoms when attempting to stop the behavior (e.g., the shakes). More recently, such addictions (including addictions to the Internet and slot machines) have been termed "technological addictions" (Griffiths, 1995a, 1996a) and have been operationally defined as non-chemical (behavioral) addictions that involve excessive human–machine interaction. They can either be passive (e.g., television) or active (e.g., computer games), and usually contain inducing and reinforcing features which may contribute to the promotion of addictive tendencies (Griffiths, 1995a). Technological addictions can thus be viewed as a subset of behavioral addictions (Marks, 1990) and feature core components of addiction first outlined by Brown (1993) and modified by Griffiths (1996b), i.e., salience, mood modification, tolerance, withdrawal, conflict, and relapse. It is my contention that any behavior (e.g., videogame playing) that fulfills these six criteria is therefore operationally defined as an addiction. In the case of videogame addiction it would be:

Salience—This occurs when videogame play becomes the most important activity in the person's life and dominates their thinking (preoccupations and cognitive distortions), feelings (cravings), and behavior (deterioration of socialized behavior). For instance, even if the person is not

actually playing on a videogame they will be thinking about the next time that they will be.

Mood modification—This refers to the subjective experiences that people report as a consequence of engaging in videogame play and can be seen as a coping strategy (i.e., they experience an arousing "buzz" or a "high" or paradoxically tranquilizing feel of "escape" or "numbing").

Tolerance—This is the process whereby increasing amounts of videogame play are required to achieve the former mood modificating effects. Thus for someone engaged in videogame playing, they gradually build up the amount of the time they spend engaged in the behavior.

Withdrawal symptoms—These are the unpleasant feeling states and/or physical effects which occur when videogame play is discontinued or suddenly reduced. These include the shakes, moodiness, irritability, etc.

Conflict—This refers to the conflicts between the videogame player and those around them (interpersonal conflict), conflicts with other activities (job, schoolwork, social life, hobbies, and interests) or from within the individual themselves (intrapsychic conflict and/or subjective feelings of loss of control) which are concerned with spending too much time engaged in videogame play.

Relapse—This is the tendency for repeated reversions to earlier patterns of videogame play to recur and for even the most extreme patterns typical of the height of excessive videogame play to be quickly restored after periods of abstinence or control.

Does Videogame Addiction Exist?

Having operationally defined addiction above, it is my belief that videogame addiction does indeed exist but that it affects only a very small minority of players. There appear to be many people who use videogames excessively but are not addicted as measured by these (or any other) criteria.

If Videogame Addiction Exists, What Are People Actually Addicted To?

The third question is perhaps the most interesting and the most important when it comes to research in this field. What are people actually addicted to? Is it the interactive medium of playing? Aspects of its specific style (e.g., an anonymous and disinhibiting activity)? The specific types of games (aggressive games, strategy games, etc.)? This has led to much debate among those working in this field. Research being carried out into Internet addiction may lead to

insights about videogame addiction. For instance, Young (1999) has claimed that Internet addiction is a broad term covering a wide variety of behaviors and impulse-control problems. This is categorized by five specific subtypes:

Cybersexual addiction: compulsive use of adult websites for cybersex and cyberporn.
Cyber-relationship addiction: overinvolvement in online relationships.
Net compulsions: obsessive online gambling, shopping, or day-trading.
Information overload: compulsive web surfing or database searches.
Computer addiction: obsessive computer game playing (e.g., *Doom*, *Myst*, *Solitaire*, etc.)

I have argued (Griffiths, 1999, 2000a) that many of these excessive users are not "Internet addicts" but just use the Internet excessively as a medium to fuel other addictions. Put very simply, a gambling addict or a computer game addict who engages in their chosen behavior online is not addicted to the Internet. The Internet is just the place where they engage in the behavior. However, in contrast to this, there are case study reports of individuals who appear to be addicted to the Internet itself (e.g., Young, 1998; Griffiths, 1996a, 1998, 2000b). These are usually people who use Internet chat rooms or play fantasy role-playing games—activities that they would not engage in except on the Internet itself. These individuals to some extent are engaged in text-based virtual realities and take on other social personas and social identities as a way of making them feel good about themselves. In these cases, the Internet may provide an alternative reality to the user and allow them feelings of immersion and anonymity that may lead to an altered state of consciousness. This in itself may be highly psychologically and/or physiologically rewarding. Obviously for those playing online computer games, these speculations may provide insights into the potentially addictive nature of computer games for those playing in this medium.

Other insights into the potentially addictive nature of videogames has come from research into slot machines. Both videogame machines and slot machines may be considered under the generic label of "amusement machines" (Griffiths, 1991a). The main difference between videogame machines and slot machines are that videogames are played to accumulate as many points as possible whereas slot machines are played (i.e., gambled upon) to accumulate money. I have suggested (Griffiths, 1991a) that playing a videogame could be considered as a non-financial form of gambling. Both types of machine (in the case of arcade games) require insertion of a coin to play, although the playing time on a slot machine is usually much less than on a videogame machine. This is because on videogames the outcome is almost solely due to skill, whereas on slot machines the outcome is more likely to

be a product of chance. However, the general playing philosophy of both slot machine players and videogame players is to stay on the machine for as long as possible using the least amount of money (Griffiths, 1990a, 1990b). I have also argued that regular slot machine players play *with* money rather than for it, and that winning money is a means to an end (i.e., to stay on the machine as long as possible).

Besides the generic labeling, their geographical juxtaposition, and the philosophy for playing, it could be argued that on both a psychological and behavioral level, slot machine gambling and videogame playing share many similarities (e.g., similar demographic differences such as age and gender breakdown, similar reinforcement schedules, similar potential for "near miss" opportunities, similar structural characteristics involving the use of light and sound effects, similarities in skill perception, similarities in the effects of excessive play, etc.) (Griffiths, 2005a). The most probable reason the two forms have rarely been seen as conceptually similar is because videogame playing does not involve the winning of money (or something of financial value) and therefore cannot be classed as a form of gambling. However, the next generation of slot machines are starting to use videogame graphics and technology. While many of these relate to traditional gambling games (e.g., roulette, poker, blackjack, etc.) there are plans for developing video gambling games in which people would win money based on their game scores. This obviously gives an idea of the direction that slot machines and the gaming industry are heading.

Furthermore, there are a growing number of researchers who suggest that arcade videogames share some common ground with slot (gambling) machines including the potential for dependency (e.g., Brown & Robertson, 1993; Fisher, 1994; Griffiths, 1991a, 1993, 1997a, 2005a; Gupta & Derevensky, 1996; Wood, Griffiths, Chappell, & Davies, 2004). As Fisher and Griffiths (1995) point out, arcade videogames and slot machines share some important structural characteristics, these being:

- the requirement of response to stimuli which are predictable and governed by the software loop.
- the requirement of total concentration and hand–eye coordination.
- rapid span of play negotiable to some extent by the skill of the player (more marked in videogames).
- the provision of aural and visual rewards for a winning move (e.g., flashing lights, electronic jingles).
- the provision of an incremental reward for a winning move (points or cash), which reinforces "correct" behavior.
- digitally displayed scores of "correct behavior" (in the form of points or cash accumulated).

- the opportunity for peer group attention and approval through competition.

As with excessive slot machine playing, excessive videogame playing partly comes about by the partial reinforcement effect (PRE) (Wanner, 1982). This is a critical psychological ingredient of videogame addiction whereby the reinforcement is intermittent—that is, people keep responding in the absence of reinforcement hoping that another reward is just around the corner. Knowledge about the partial reinfrorcement effect gives the videogame designer an edge in designing appealing games. Magnitude of reinforcement is also important. Large rewards lead to fast responding and greater resistance to extinction—in short to more "addiction." Instant reinforcement is also satisfying.

Videogames rely on multiple reinforcements (i.e., the "kitchen sink" approach) in that different features might be differently rewarding to different people. Success on videogames comes from a variety of sources and the reinforcement might be intrinsic (e.g., improving your highest score, beating your friend's high score, getting your name on the "hall of fame," mastering the machine) or extrinsic (e.g., peer admiration). Malone (1981) has also reported that videogames are positively correlated to (i) a presence or absence of goals, (ii) the availability of automatic computer scores, (iii) the presence of audio effects, (iv) the random quality of the games, and (v) the degree to which rapid reaction times enhance game scores.

Empirical Research on Videogame Addiction

To date, there has been very little research directly investigating videogame addiction. Furthermore, almost all of it has concentrated on adolescents only. Shotton (1989) carried out a study specifically on "computer addiction" using a sample of 127 people (half being children, half adult; 96% male) who had been self-reportedly "hooked" on home videogames for at least five years. Seventy-five of these were measured against two control groups, and it was reported that the computer-dependent individuals were highly intelligent, motivated, and achieving people but often misunderstood. Following-up after five years, Shotton found that the younger cohort had done well educationally, gone on to university and then into high ranking jobs. However, Shotton's research was done with people who were familiar with the older generation of videogames that were popular in the earlier part of the 1980s. The videogames of the 1990s onwards may in some way be more psychologically rewarding than the games of a decade ago in that they require more complex skills, improved dexterity, and feature

socially relevant topics and better graphics. Anecdotal accounts of greater psychological rewards could mean that the newer games are more "addiction inducing," although such an assertion needs empirical backing.

A more recent questionnaire study was undertaken by Griffiths and Hunt (1995, 1998) with almost 400 adolescents (12 to 16 years of age) to establish the level of "dependence" using a scale adapted from the DSM-III-R criteria for pathological gambling (American Psychiatric Association, 1987). Eight questions relating to the DSM-III-R criteria were adapted for computer game playing and examined a number of addiction components including:

1 salience ("Do you frequently play most days?")
2 tolerance ("Do you frequently play for longer periods of time?")
3 euphoria ("Do you play for excitement or a 'buzz'?")
4 chasing ("Do you play to beat your personal high score?")
5 relapse ("Do you make repeated efforts to stop or decrease playing?")
6 withdrawal ("Do you become restless if you cannot play?")
7 conflict ("Do you play instead of attending to school-related activities?"
8 conflict ("Do you sacrifice social activities to play?")

A cut-off point of four was assumed to indicate a participant was playing at dependent (i.e., addictive) levels at the time of the study. Scores on the adapted DSM-III-R scale indicated that 62 players (19.9%) were dependent on computer games (i.e., scored four or more on the scale). Furthermore, 7% of the sample claimed they played over 30 hours a week. The dependence score correlated with gender—that is, significantly more males than females were dependent. Dependence score also correlated with how often they played computer games, the mean session length playing time, and the longest single session playing time. Further analysis indicated that those dependent were significantly more likely to have started playing computer games to impress friends, because there was nothing else to do, for a challenge, and to meet friends. Dependent players were also significantly more likely to report aggressive feelings as a direct result of their computer game playing. There are a number of problems with the findings of this study. Although the criteria for the scale were all based on the different components of dependence common to other addictive behaviors (e.g., salience, euphoria, tolerance, withdrawal, conflict, etc.) it could be that these are less relevant for excessive computer game playing. There was also an assumption made that computer game playing was similar to gambling in terms of the consequences of excessive behavior.

Alternative explanations could be that excessive computer game playing cannot be conceptualized as an addiction at all or that the scale is more

a measure of preoccupation rather than dependence. A replication study found very similar results (Griffiths, 1997b). It is also worth noting that 7% of the sample in Griffiths and Hunt's (1995, 1998) study claimed to play computer games for over 30 hours a week. Similar findings have also been reported in other studies (Fisher, 1994; Griffiths, 1997b; Parsons, 1995; Phillips, Rolls, Rouse, & Griffiths, 1995; Tejeiro-Delguero & Moran, 2002). However, it is worth noting that Charlton's (2002) factor analytic study of computer addiction showed a blurring of distinction between non-pathological high engagement and addiction. Therefore, it could alternatively be the case that there are very excessive gamers who show few negative consequences in their life.

There is no doubt that for a minority of children and adolescents, videogames can take up considerable time. Whether these studies suggest videogames may be addictive is perhaps not the most salient issue here. The question to ask is: What is the longitudinal effect of any activity (not just videogame playing) that takes up 30 hours of leisure time a week on the educational and social development of children and adolescents? At present we do not know the answer to this question. However, it is my contention that any child who engaged in any activity excessively (whether defined as an addiction or not) every day over a number of years from a young age, would have their social and/or educational development negatively affected in some way.

There is also the question that if videogames are addictive, then what is the addictive process? One potential way of answering this question is to produce possible theoretical accounts of videogame addiction and test the hypotheses empirically. McIlwraith (1990) proposed four theoretical models of television addiction in the popular and psychological literature that would seem good models to test the boundaries of videogame addiction. Substituting "videogame" for "television" in McIlwraith's account would leave the four explanations as thus:

That videogame addiction is a function of the videogame's effects on imagination and fantasy life—that is, people who play videogames to excess have poor imaginations.

That videogame addiction is a function of the videogame's effects on arousal level—that is, people who play videogames to excess either do so for its arousing or tranquilizing effects.

That videogame addiction is a manifestation of oral, dependent, or addictive personality—that is, people who play videogames to excess do so due to their inner personality as to opposed to the external source of the addiction.

That videogame addiction is a distinct pattern of uses and gratifications

associated with the videogame medium—that is, people who play videogames to excess enjoy the physical act of playing or play only when they are bored, etc.

Few of these explanations for home videogame playing have been empirically studied, although some empirical evidence by Griffiths and Dancaster (1995), and evidence from arcade videogame addiction (Fisher, 1994) appears to support the second theoretical orientation, that videogame addiction is a function of the videogame's effects on arousal level. Recent research by Koepp, Gunn, Lawrence, Cunningham, Dagher, Jones, et al. (1998) demonstrated dopaminergic neurotransmission during the playing of a videogame. This may have implications for understanding the underlying addictive process in the playing of videogames. If it is accepted that videogame playing can be addictive then it is appropriate to look for the neural foundation of such behavior. Over recent years the role of the mesotelencephalic (nucleus accumbens) dopaminergic system that is constructed as a circuit between the midbrain and the forebrain (within the medial forebrain bundle) has been widely accepted as the neural substrate of reinforcement (Julien, 1995). The work has until now focused on modeling the psychopharmacological process of drug-seeking behavior.

In addition to neurochemical research, there are further reports of behavioral signs of videogame dependency among adolescents. Dependency signs reported include stealing money to play arcade games or to buy new games cartridges (Griffiths & Hunt, 1995; 1998; Keepers, 1990; Klein, 1984), truanting from school to play (Griffiths & Hunt, 1998; Keepers, 1990), not doing homework/getting bad marks at school (Griffiths & Hunt, 1998; Phillips et al., 1995), sacrificing social activities to play (Egli & Meyers, 1984; Griffiths & Hunt, 1998), irritability and annoyance if unable to play (Griffiths & Hunt, 1998; Rutkowska & Carlton, 1994), playing longer than intended (Egli & Meyers, 1984; Griffiths & Hunt, 1998) and an increase in self-reported levels of aggression (Griffiths, & Hunt, 1995). There is no doubt that for a minority of people (particularly adolescents) videogames can take up considerable time and that to all intents and purposes they are "addicted" to them. However, the prevalence of such an addiction is still of great controversy, as is the mechanism by which people may become addicted. This is one area where research appears to be much needed. The need to establish the incidence and prevalence of clinically significant problems associated with videogame addiction is of paramount importance. There is no doubt that clearer operational definitions are required if this is to be achieved.

It has been argued above that the only way of determining whether nonchemical (i.e., behavioral) addictions (such as videogame addiction) are

addictive in a non-metaphorical sense is to compare them against clinical criteria for other established drug-ingested addictions. However, most people researching in the field have failed to do this, which has perpetuated the skepticism shown in many quarters of the addiction research community. The main problems with the addiction criteria suggested by most researchers in the field is that the measures used (i) have no measure of severity, (ii) have no temporal dimension, (iii) have a tendency to overestimate the prevalence of problems and (iv) take no account of the context of videogame use. There are also concerns about the sampling methods used. As a consequence, none of the surveys to date conclusively shows that videogame addiction exists or is problematic to anyone but a small minority. At best, they indicate that videogame addiction may be prevalent in a significant minority of individuals but that more research using validated survey instruments and other techniques (e.g., in-depth qualitative interviews) are required. Case studies of excessive videogame players may provide better evidence of whether videogame addiction exists because the data collected are much more detailed. Even if just one case study can be located it indicates that videogame addiction actually does exist—even if it is unrepresentative. There are case study accounts in the literature which appear to show that excessive videogame players display many signs of addiction (e.g., Keepers, 1990) including those that play online (e.g., Griffiths, 2000b; Griffiths, Davies, & Chappell, 2003, 2004a, 2004b). These case studies tend to show that the videogames are used to counteract other deficiencies and underlying problems in the person's life (e.g., relationships, lack of friends, physical appearance, disability, coping, etc.). Again, further work of a more in-depth qualitative nature is needed to confirm the existence of videogame addiction.

Excessive Videogame Play—Other Negative Consequences

Other indirect evidence of addictive and excessive play comes from the many health consequences that have been reported in the literature. The risk of epileptic seizures while playing videogames in photosensitive individuals with epilepsy is well established (e.g., Graf, Chatrian, Glass, & Knauss, 1994; Harding & Jeavons, 1994; Maeda, Kurokawa, Sakamoto, Kitamoto, Kohji, & Tashima, 1990; Millett, Fish, & Thompson, 1997; Quirk, Fish, Smith, Sander, Shorvon, & Allen, 1995). Graf et al. (1994) report that seizures are most likely to occur during rapid scene changes, and high intensity repetitive and flickering patterns. However, for many individuals, seizures during play will represent a chance occurrence without a causal

link. Furthermore, there appears to be little direct link to excessive and/or addictive play because occasional players appear to be just as susceptible.

In addition to photosensitive epilepsy, the medical profession for over 20 years has voiced a number of concerns about videogame playing. Back in the early 1980s, rheumatologists described cases of "Pac-man's Elbow" and "Space Invaders' Revenge" in which players have suffered skin, joint, and muscle problems from repeated button hitting and joystick pushing on the game machines (Loftus & Loftus, 1983). Early research by Loftus and Loftus indicated that two-thirds of (arcade) videogame players examined complained of blisters, calluses, sore tendons, and numbness of fingers, hands, and elbows directly as a result of their playing. There have been a whole host of case studies in the medical literature reporting some of the adverse effects of playing videogames (see Griffiths, 2003, 2005b). These have included auditory hallucinations (Spence, 1993), enuresis (Schink, 1991), encoprisis (Corkery, 1990), wrist pain (McCowan, 1981), neck pain (Miller, 1991), elbow pain (Miller, 1991), tendosynovitis—also called "nintendinitis"—(Brasington, 1990; Casanova & Casanova, 1991; Reinstein, 1983; Siegal, 1991), hand–arm vibration syndrome (Cleary, McKendrick, & Sills, 2002), repetitive strain injuries (Mirman & Bonian, 1992), and peripheral neuropathy (Friedland & St. John, 1984). Admittedly, some of these adverse effects are quite rare and "treatment" simply involved non-playing of the games in question. In fact, the cases involving enuresis and encoprisis, the children were so engaged in the games that they did not want to go to the toilet. In these particular cases they were simply taught how to use the game's "pause" button!

There has also been some speculation that excessive play may have a negative effect on both heart rate and blood pressure. One study (Gwinup, Haw, & Elias, 1983) suggested that some individuals with cardiovascular disease could experience adverse effects. More recent research has highlighted both gender and ethnic differences in cardiovascular activity during game play (see Murphy, Stoney, Alpert, & Walker, 1995). Although some authors (e.g., Segal & Dietz, 1991) have suggested that game playing may lead to increased energy expenditure when compared with activities such as watching television, the energy increase identified is not sufficient to improve cardiorespiratory fitness.

Other speculative (i.e., non-empirically tested) negative aspects of videogame playing that have been reported include the belief that videogame play is socially isolating and prevents children from developing social skills (Zimbardo, 1982). For instance, Selnow (1984) reported that videogame players use the machine as "electronic friends." However, this does not necessarily mean that players play the machines instead of forming human friendships and interacting with their peer groups. Further to this, Colwell, Grady, and Rhaiti (1995) reported that heavy videogame players see friends more often

outside school (and have a need for friends) more than non-heavy players. Rutkowska and Carlton (1994) reported there was no difference in "sociability" between high and low frequency players and reported that games foster friendship. This finding was echoed by Phillips et al. (1995), who found no difference in social interactions between players and non-players.

It has also been suggested that videogame playing may prevent children and adolescents from participating in more educational or sporting pursuits (Egli & Meyers, 1984; Professional Association of Teachers, 1994). In this context, it is worth noting that childhood obesity has also been linked with videogames. For instance, Shimai, Yamada, Masuda, & Tada (1993) found that obesity was correlated with long periods of videogame playing in Japanese children. This finding has also been found in young French children (Deheger, Rolland-Cachera, & Fontvielle, 1997). In the UK, Johnson and Hackett (1997) reported that there was an inverse relationship between physical activity and playing videogames in schoolgirls.

What is clear from the case studies displaying the more negative consequences of playing is that they all involved people who were excessive users of videogames. From prevalence studies in this area, there is little evidence of serious acute adverse effects on health from moderate play. Adverse effects are likely to be relatively minor, and temporary, resolving spontaneously with decreased frequency of play, or to affect only a small subgroup of players. Excessive players are the most at risk from developing health problems although more research appears to be much needed. The need to establish the incidence and prevalence of clinically significant problems associated with videogame play is of paramount importance. There is also no doubt that clearer operational definitions are required if this is to be achieved.

Taking all factors and variables into account and by considering the prevalence of play, the evidence of serious adverse effects on health is rare. An overview of the available literature appears to indicate that adverse effects are likely to affect only a very small subgroup of players and that frequent players are the most at risk from developing health problems. Those that game play does affect will experience subtle, relatively minor, and temporary effects that resolve spontaneously with decreased frequency of play. However, the possible long term effects and its relationship to conditions such as obesity have not been fully examined and must remain speculative.

Conclusions

This chapter has demonstrated that research into videogame addiction is a little-studied phenomenon. Obviously more research is needed before the debate on whether videogame addiction is a distinct clinical entity is

decided. From the sparse research, it is evident that videogames appear to be at least potentially addictive. There is also a need for a general taxonomy of videogames as it could be the case that particular types of games are more addictive than others. Another major problem is that videogames can be played in lots of different ways including handheld consoles, personal computers, home videogame consoles, arcade machines, and on the Internet. It may be the case that some of these media for playing games (such as in an arcade or on the Internet) may be more addictive because of other factors salient to that medium (e.g., disinhibition on the Internet). Therefore future research needs to distinguish between excessive play in different media.

Research also demonstrates that males are the most excessive users of videogames (Griffiths, 1991b, 1993, 1997a; Kaplan, 1983); this again mirrors many other youth addictions (Griffiths, 1995b). Reasons as to why males play videogames significantly more than females have been generally lacking. Explanations may include:

1 The content of the games—Most videogames have traditionally contained masculine images (Braun, Goupil, Giroux, & Chagnon, 1986) although this is changing with the introduction of strong female lead characters like Lara Croft. Furthermore, videogames have been and continue to be predominantly designed by males for male consumers (Gutman, 1982) Although there have been "female" forms of game hardware and software introduced, e.g., *Ms. Pac-man* and Nintendo's *Game Girl*, there are fewer games designed specifically for females than those designed for males.
2 Socialization—Women are not encouraged to express aggression in public and feel uncomfortable with games of combat or war (Surrey, 1982). It could be that male domination of videogames is due more to the arcade atmosphere, its social rules and socialization factors than the games themselves.
3 Sex differences—Males, on average, perform better in visual and spatial skills (particularly depth perception) (Maccoby & Jacklin, 1974) and hand–eye coordination (Keisler, Sproull, & Eccles, 1983) which are essential to good game playing. Therefore, the average male player would be more likely to score higher than the average female player and thus be more likely to persist in playing.

It is also apparent that there are gender differences between the types of game played. For example, Griffiths and Hunt (1995) reported that males preferred "beat 'em ups" and "puzzlers" and that females preferred "platform" games. Another study by Griffiths (1997b) reported that males play

more "beat 'em ups" and sport simulations, and that females play more "puzzlers" and "platformers." Although there are some slight differences in these findings, they do seem to suggest that males prefer the more aggressive type of games. In fact, Griffiths (1997b) went on to report that 42% of boys' favourite games were violent whereas only 9% of the girls' were. This was also echoed by Parsons (1995), who reported that females prefer less aggressive games than males, and that males prefer violence. More research is therefore needed into the relationship (if any) between violent videogames and potential addictiveness. There is also the question of developmental effects—that is, do videogames have the same effect regardless of age? It could well be the case that videogames have a more pronounced addictive effect in young children but less of an effect (if any) once they have reached their adult years. There is also the social context of playing—that is, does playing in groups or individually, with or against each other affect potential addictiveness of games in any way? These all need further empirical investigation.

It does appear that excessive videogame playing can have potentially damaging effects upon a minority of individuals who display compulsive and addictive behavior, and who will do anything possible to "feed their addiction." Such individuals need monitoring. Using these individuals in research would help identify the roots and causes of addictive playing and the impact of such behavior on family and school life. It would be clinically useful to illustrate problem cases, even following them longitudinally and recording developmental features of the adolescent videogame addict. This would help determine the variables that are salient in the acquisition, development, and maintenance of videogame addiction. It may be that videogame addiction is age related like other more obviously "deviant" adolescent behaviors (e.g., glue sniffing), since there is little evidence to date of videogame addiction in adults.

There is no doubt that videogame play usage among the general population will continue to increase over the next few years, and that if social pathologies (including videogame addiction) do exist then this is certainly an area for development that should be of interest and concern to all those involved in the addiction research field. Real-life problems need applied solutions and alternatives, and until there is an established body of literature on the psychological, sociological, and physiological effects of videogame playing and videogame addiction, directions for education, prevention, intervention, and treatment will remain limited in scope. The time has come for the addiction research community to take videogame addiction seriously.

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